Refining element

This invention relates to refining elements for use in refiners for working lignocellulosic fibrous material, in which the refining means rotary relative to each other are provided with refining elements, which between themselves form a refining gap. The refining elements are provided with bars and intermediate grooves for working the material. The refining means can be angular in relation to the radial plane, so that a conical refining gap is formed between opposed refining elements, or can be formed with a radial portion located nearest to the rotation axis and a subsequent conical portion. The refining means with the conical surface located inside is rotary, while the refining means with the conical surface located outside is stationary.

An especially field of application for the invention is refiners for the manufacture of fiber - or papermaking pulp from wood chips or similar cellulosic material. Refiners of disc-type are formed with a refining gap between the refining elements of the refining means extending in radial direction, which gap proceeds from a central feed zone for the raw material where the centrifugal force is relatively low. The centrifugal force acting on the refining material then increases with increasing radius very strongly. In order to prolong the stay-time in the outer portion of the refining gap, the refining gap in the outer portion can be formed conical, with an extension at an angle in relation to the radial direction, so that only part of the centrifugal force is allowed to act on the refining material in the flow direction of the gap. The refining gap, thus, consists of an inner radial zone and an outer conical zone.

This implies that the refining material in the conical zone by the effect of the centrifugal force and the bars on the refining elements located inside is thrown outward to the refining elements located outside. The refining material contains substantially fibrous material, but impurities in the form of sand and other abrasive material can in certain cases follow along with the fibrous material. The aforesaid flow conditions arise to an increased wear of the bars on the refining element located outside. It was found that wear primarily implies that the edges of the bars on these refining elements are worn at least twice as fast as corresponding bar edges on the inside located refining elements. As the wear of the bars on the refining elements causes a deterioration of the quality of the worked material, the refining elements must be exchanged before the quality has become unacceptable. Furthermore, the energy consumption in the refiner increases.

Every exchange of refining elements is not only expensive, it means also that the refiner must be taken out of operation, which means loss of production.

The invention has the object to reduce the above problems, in that the refining elements intended for the outside located refining means is given in the conical zone a configuration, which to the greatest possible extent counteracts the wear. This is achieved in that the bars on these refining elements are formed with an acute edge angle, as defined in the claims.

The bars of the refining elements can be in parallel with the generatrix of the conical surface or be angled in relation to it. The bars are defined by a front and a rear side surface, counted in the intended direction of the material flow over the bars, and an upper side surface, which forms a portion of the conical surface. This implies that at least the upper portion of the front side surface of the bars shall be inclined inward, so that an acute edge angle is formed between the side surface of the bars and the upper surface. This angle shall be between 50° and 90°, suitably between 60° and 90° and preferably between 70° and 80°, and the angled portion of the side surface should be at least one third of the height of the bars.

By forming the bars in this way, it was found possible to reduce the wear of the front edge of the bars. Due to the acute angle the fibrous material is easier guided away from the front edge, whereby the wear is reduced without deteriorating the working of the fibrous material. This implies a longer service life for the refining element and reduced energy consumption at maintained pulp quality.

The invention is described in greater detail with reference to the accompanying Figures illustrating an embodiment of the invention.

Fig. 1 shows schematically a refiner with an inner radial and an outer angled refining gap portion.

Figs. 2 and 3 are on an enlarged scale sections along A-A in Fig. 1 in two alternative configurations of the bars of the refining elements.

The refiner shown in Fig. 1 is formed with a stationary refining means 1 and a rotary refining means 2 mounted on a rotary shaft 3. The refining gap can be adjusted by axial movement of the shaft 3. The refining means are enclosed in an impervious refining housing 4. Between the refining means a refining gap is formed, which consists of an inner radial portion 5 and an outer angled portion 6. The inclination angle to the rotor axis should be less than 45°, suitably between 10° and 30°. The stationary refining means 1 is formed with a central opening 7, through which the refining material is supplied.

Each refining means is provided with wear portions in the form of refining elements 8-11 both in the inner radial portion of the refining gap 5 and in the outer angled portion 6. The refining elements are provided with bars 12 and intermediate grooves 13 for working and refining the refining material. The bars are defined by an upper surface 14 and two side surfaces 15,16.

In the outer angled portion 6 of the refining gap the stationary refining means 1 is located outside the rotary refining means 2. The refining elements 10,11 on these refining means 1,2, thus, are placed outside and, respectively, inside the outer angled portion 6 of the refining gap.

According to Fig. 2 the outside located refining element 11 is provided with bars 12, where the front side surface 15, counted in the intended flow direction of the material to be refined, forms an acute angle α with the upper surface 14 of the bars. The bars on the inside located refining element 10 are formed conventionally.

According to Fig. 3 the outside located refining element 11 is provided with bars 12, where both side surfaces 15,16 form an acute angle α with the upper surface 14. In this case the rotation direction of the inner refining element 10 can be changed and, thus, the flow direction of the material to be refined in relation to the outer refining element 11 at maintained effect according to the invention. Also at this design the bars on the inside located refining element 10 are formed conventionally.

At working the fibrous material in the refining gap the material to be refined is supplied to the central feed zone between the refining means through the opening 7 in the stationary refining means 1 by means of a conveying screw 18, which is mounted co-

axially with the shaft 3. Thereby the material to be refined is caused to move outward through the inner radial portion 5 of the refining gap and worked simultaneously by the radial refining elements 8,9. Thereafter the material to be refined is moved into the outer angled portion 6 of the refining gap to be worked further by the angled refining elements 10,11. Due to its design and the rotation of the refining means 2, the bars on the inside located refining element 10 will throw the material to be refined outward to the outside located refining element 11. Due to the acute angle α of the bar edges the fibrous material is easier guided away from the front edge, which reduces the wear without deteriorating the working of the fibrous material. This implies a longer service life for the refining element and decreased energy consumption at maintained pulp quality.

The invention is not restricted to the embodiment shown, but can be varied within the scope of the inventive idea.